

connection stability between the heatsink 21 and the heat conduction paths 11 can be ensured.

[0035] FIG. 5 is a diagram illustrating a modification example of the circuit board 10 (in FIG. 5, the same components as those in FIG. 2A are denoted by the same reference signs). In the example illustrated in FIG. 5, the circuit board 10 has a metal layer 18 on its lower surface (surface facing the heatsink 21). The metal layer 18 is formed, for example, over the entire area where the plurality of through holes h1 are formed and connect the plurality of heat conduction paths 11. In the case where the circuit board 10 has the metal layer 18, the heatsink 21 is connected to the metal layer 18. In this case, the heatsink 21 may be in direct contact with the metal layer 18. Alternatively, the connecting member 32 which is the above heat conduction sheet, thermal grease, or another member, may be disposed between the heatsink 21 and the metal layer 18. The metal layer 18 is formed of, for example, the same material as the circuit patterns 15. This allows the metal layer 18 and the circuit patterns 15 (specifically, the circuit patterns 15 formed on the lower surface of the circuit board 10) to be formed by the same process during manufacture of the circuit board 10.

[0036] It should be noted that a metal layer 17 for connecting the plurality of heat conduction paths 11 is also formed on the upper surface of the circuit board 10 in the example illustrated in FIG. 5. The metal layer 17 is formed, for example, over the entire area where the plurality of through holes h1 are formed and connects the plurality of heat conduction paths 11. In the case where the circuit board 10 has the metal layer 17, the heat conduction pad 5a of the integrated circuit apparatus 5 is connected to the metal layer 17. In this case, the heat conduction pad 5a may be soldered to the metal layer 17. Instead of soldering, the connecting member 31 which is the above heat conduction sheet, thermal grease, or another member, may be disposed between the heat conduction pad 5a and the metal layer 17. The metal layer 17 is formed of, for example, the same material as the circuit patterns 15. This allows the metal layer 17 and the circuit patterns 15 (specifically, the circuit patterns 15 formed on the upper surface of the circuit board 10) to be formed by the same process during manufacture of the circuit board 10.

[0037] FIG. 6 is a sectional view illustrating a modification example of the heat conduction paths 11. In FIG. 6, the same components as those in FIG. 1 are denoted by the same reference signs. In the example of electronic equipment 100 illustrated in FIG. 6, the circuit board 10 has a through hole h3. The through hole h3 has a width W3 greater than the width W2 of the connecting hole h2 described above. More specifically, the width W3 is even greater than a spacing W4 between the two solder balls 5b. The width W3 is greater than half the size of the heat conduction pad 5a of the integrated circuit apparatus 5. The width W3 may substantially fit the width of the heat conduction pad 5a of the integrated circuit apparatus 5. A heat conduction path 111 is filled in the through hole h3. That is, the heat conduction path 111 is formed over the entire area of the through hole h3. The formation of the relatively large through hole h3 allows for even more efficient heat conduction from the integrated circuit apparatus 5 to the heatsink 21.

[0038] As described above, the integrated circuit apparatus 5 may be a Sip having a plurality of IC chips (silicon die) sealed inside a single package. FIG. 7 is a plan view

illustrating an example of the circuit board 10 on which the integrated circuit apparatus 5 as described above is mounted. In the diagram, an area D indicates an area where the integrated circuit apparatus 5 is disposed. Areas D1, D2, and D3 indicate the positions of the plurality of IC chips of the integrated circuit apparatus 5, respectively. In the circuit board 10, heat conduction paths 111A and 111B for connecting the integrated circuit apparatus 5 and the heatsink 21 are formed. The positions of the heat conduction paths 111A and 111B correspond to the positions of the IC chips of the integrated circuit apparatus 5. That is, the heat conduction paths 111A and 111B are located in the areas D1 and D2, respectively. This ensures efficient cooling of the IC chips of the integrated circuit apparatus 5. The heat conduction paths 111A and 111B need not have the same shape. The shapes of the heat conduction paths 111A and 111B may be changed as appropriate to match the positions of the respective IC chips and the circuit patterns 15 formed in the circuit board 10.

[0039] It should be noted that heat conduction paths may not be provided for some of the IC chips of the integrated circuit apparatus 5. For example, heat conduction paths may not be provided for those IC chips that generate only a small amount of heat. In the example illustrated in FIG. 7, no heat conduction paths are provided for the IC chips disposed in the area D3.

[0040] As described above, in the examples of the electronic equipment 1 and the electronic equipment 100, the heatsink 21 is disposed on the lower surface of the circuit board 10. The circuit board 10 has the through holes h1 and h3 that penetrate the circuit board 10 in the area A where the integrated circuit apparatus 5 is disposed. In the through holes h1 and h3, the heat conduction paths 11, 111, 111A, and 111B are provided. The heat conduction paths 11, 111, 111A, and 111B connect the integrated circuit apparatus 5 and the heatsink 21, allowing heat conduction from the integrated circuit apparatus 5 to the heatsink 21 via the heat conduction paths 11, 111, 111A, and 111B. The heat conduction paths 11, 111, 111A, and 111B include a material having a higher thermal conductivity than the base material 10a of the circuit board 10. These structures of the electronic equipment 1 and the electronic equipment 100 ensure a higher degree of freedom in laying out other components of the electronic equipment. In the case where another heat radiating apparatus is disposed on the upper surface of the integrated circuit apparatus 5 unlike the examples of the electronic equipment 1 and the electronic equipment 100, two heat radiating apparatuses are provided on the integrated circuit apparatus 5, thus contributing to improved cooling performance.

[0041] It should be noted that the present invention is not limited to the embodiment described above and may be modified in various manners.

1. Electronic equipment comprising:

- a circuit board having a first surface and a second surface and through holes, the first surface having an electronic component disposed thereon, the second surface being on an opposite side of the first surface, and the through holes being formed in an area where the electronic component is disposed;
- a heat radiating apparatus disposed on the second surface of the circuit board and located on an opposite side of the electronic component with the circuit board provided therebetween; and